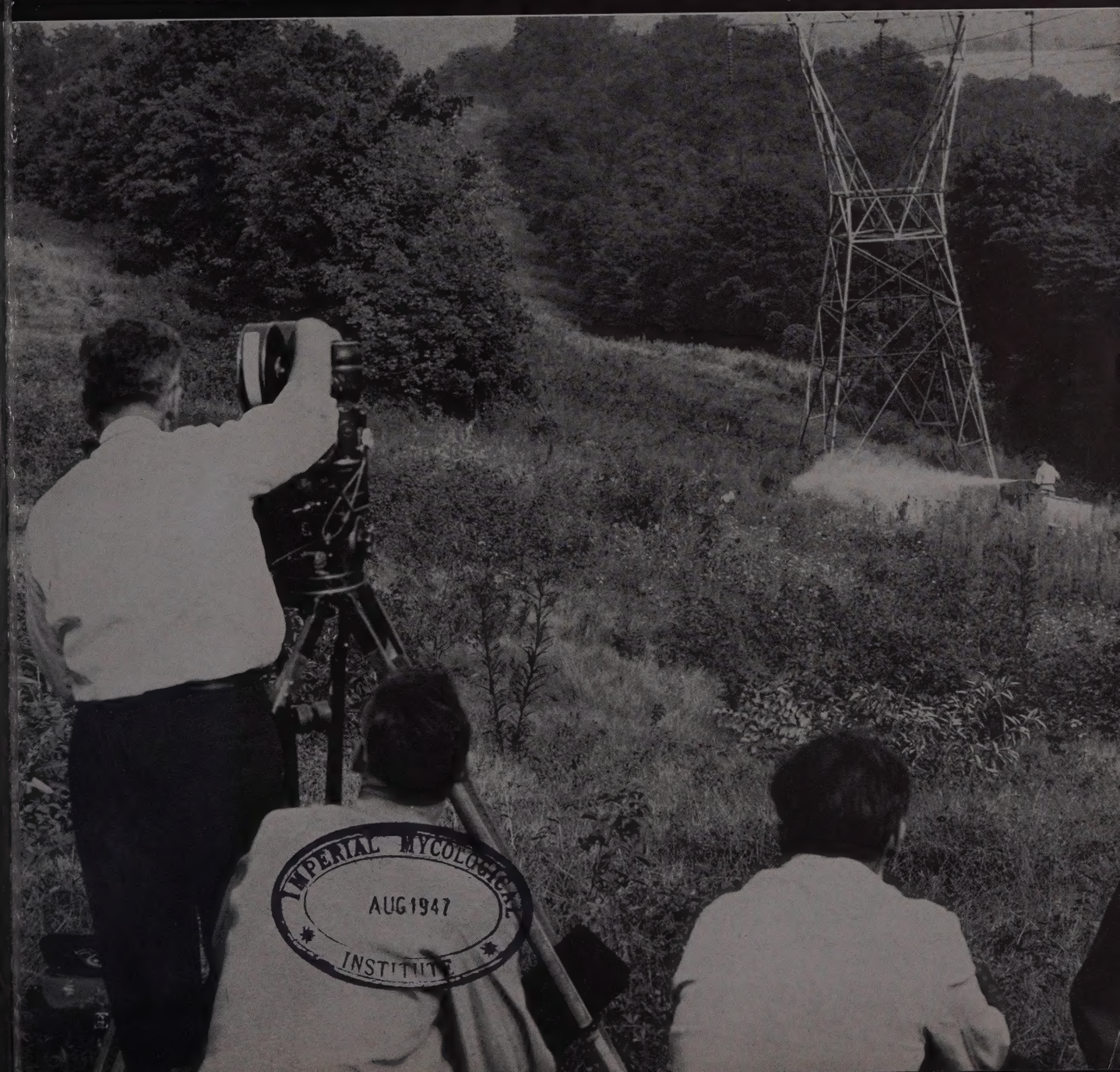
DOWN TO EARTH

COPYRIGHT 1946 BY THE DOW CHEMICAL COMPANY

A REVIEW OF AGRICULTURAL CHEMICAL PROGRESS

VOLUME 2 • NUMBER 3 • NOVEMBER, 1946



IMPERIAL MYCOLOGICAL INSTITUTE AUG 1947

2,4-D CONTROLS MOST WOODY VEGETATION

Millions of dollars are spent annually in laboriously cleaning brush. In recent tests on rights-of-way of the West Penn. Power Company 2,4-D has proved to be an effective killer of many woody plants.

IF ONE ACCEPTS the definition of a weed as "a plant growing where it is not wanted", woody species may be considered among the most serious weed pests of humid areas. Millions of dollars are spent annually clearing brush from pasture land; drainage ditches; highway, railroad, telephone and power line rights-of-way. Where rainfall is plentiful, fence rows become over grown and even vacant lots are invaded with thickets of trees. When cut off at, or near the ground level, most woody species send out suckers from the stump and some sprout freely from their roots. Only by very frequent cutting is it possible to exhaust their food reserves and thus kill perennial woody plants.

2,4-D has been found to be effective on a number of woody species.[1] Abnormal growth responses are induced by sprays of this herbicide and death of leaves and woody tissues result. The material or its effect is translocated within woody plants; however, a number of factors including maturity of wood and distance appear to influence the extent to which it is carried into the under ground parts. Merely to kill the top growth of a woody plant with a chemical accomplishes no more toward eradication than cutting it off. Only by destroying the tissues that give rise to new shoots can one kill a woody plant once and for all. Thus, in estimating the value of a chemical weed killer for the control of woody plants, one must give primary consideration to the extent of re-growth.

During the summers of 1945 and 1946, The Dow Chemical Company and the West Penn. Power Company of Pittsburgh, cooperated on an intensive field research project aimed at determining the possible value of 2,4-D and other chemicals for the eradication of the many woody species found on power line rights-of-way. Power companies in mountainous areas use a considerable amount of labor for cutting this vegetation, but it soon grows back. The customary practice is to cut the brush annually or at intervals of two or three years. The growth must in no case be allowed to reach the wires, and in addition, a good pathway must be maintained for those men responsible for periodic line inspection.

The results of this experimental work indicate that when the proper methods of application are used, 2,4-D will kill a number of troublesome species. This article is a preliminary report on the subject; further investigation may uncover even better techniques. Experimental work is being continued along with the commercial spraying operations now being undertaken by the West Penn. and other power companies. Foresters and weed control specialists at several experiment stations are studying the chemical control of woody weeds and valuable contributions may be expected

[1]Herbicidal Action of 2,4-Dichlorophenoxyacetic Acid on several Shrubs, Vines, and Trees. Hamner, C. L., and Tukey, H. B., The Botanical Gazette 107:379-385, March, 1946.

DOWN TO EARTH • A Review of Agricultural Chemical Progress, Published by THE DOW CHEMICAL COMPANY, Midland, Michigan, manufacturers of agricultural chemicals. Twenty thousand copies distributed to those engaged in agricultural research in the United States and Canada. • Eugene Perrin, Editor.

IN THIS ISSUE • *2,4-D controls most woody vegetation* • *Sodium pentachlorphenate as a dormant fungicidal spray on deciduous fruit and nut trees.* • *Helicopter used in west-coast corn dusting.* • *AIF meet outlines future research needs.* • *Better dahlias produced if sprays or dusts are applied.* • *Chemicals reduce Christmas tree fire hazard.*

ON THE COVER • *West Penn Power Company weed-control experiments with 2,4-D. The camera crew is filming the scene for a weed-killer movie.*

Sumac after a years growth. Such rapid growth is typical under humid conditions.

Mr. F. A. Ashbaugh, right, and Mr. J. V. Soissons, left, examine black locust 4 weeks after spraying with Esteron 44.

from them. Meanwhile, these results may suggest new angles of approach for those confronted with similar problems.

It was learned early in the experiments that with many species, especially those with waxy leaves such as locust, the ester formulations of 2,4-D gave better results than the water soluble forms.[2]

First tests involved the spraying of brush up to ten feet or more in height in addition to the spraying of new growth from brush cut late the preceding year. It was soon learned that the best results were obtained when the spray was applied to new sucker growth ranging from two to four feet in height. It is believed that relatively more 2,4-D or its effect is translocated into the below-ground parts through such new growth, involving a relatively short distance, than from a greater height through older woody tissue. Cutting of high brush before treatment begins is desirable since the aim, in any case, should be to permit the establishment of a grass sod which will retard the development of new tree seedlings

[2] Dow Ester compositions were submitted to experimenters in 1946 under code designations G652 containing 22.75% of the methyl ester of 2,4-D and G654 containing 12% of the methyl ester of 2,4-D. Based on extensive research Dow now offers an ester composition containing 44% of the isopropyl ester of 2,4-D under the name Esteron 44.

Looking down on a thicket of elderberry a few days after spraying with Esteron. This bending downward of the stems is typical of sucker growth when sprayed while it is undergoing rapid elongation. Death of top growth takes place slowly after spraying and some time may elapse before the leaves turn brown.

Mr. Ashbaugh of West Penn., examines a sumac root in a state of decomposition after 2,4-D treatment.

and herbaceous weeds. Removal of tall brush reduces shading and thus encourages the development of grass which is not injured by the usual applications of 2,4-D. Trees and tall brush must eventually be removed to avoid the existence of an unsightly condition and a fire hazard. In general such vegetation is more easily cut while in a live condition than after killing with a chemical.

Early in this investigational work, freshly cut stumps and the stubs of recently cut suckers were treated with Esteron with encouraging results. In many instances, the growing tissue beneath the bark where new suckers arise was found to proliferate and then decay. This effect extended downward varying distances depending on the species. Later stump-treatment tests indicated that relatively strong solutions of Esteron applied in kerosene as a carrier gave superior results. One part of Esteron 44 to ninety-nine parts of kerosene is suggested. This gives a 4000 ppm solution. This treatment may not completely kill a sizable stump; some suckers are likely to arise from points below the dead tissue especially with those species that sprout from the roots. It does greatly reduce the number and vitality of suckers however, and the later job of spraying this new growth is greatly simplified. Sucker growth should be treated with a 1000 to 1500 ppm emulsion where ordinary spray equipment is used. (i.e. to 3 pints of Esteron 44 per 100 gal.) Experiments on the use of lower volumes of higher concentrations are very promising. Special atomization equipment may make possible considerable savings in cost of application.

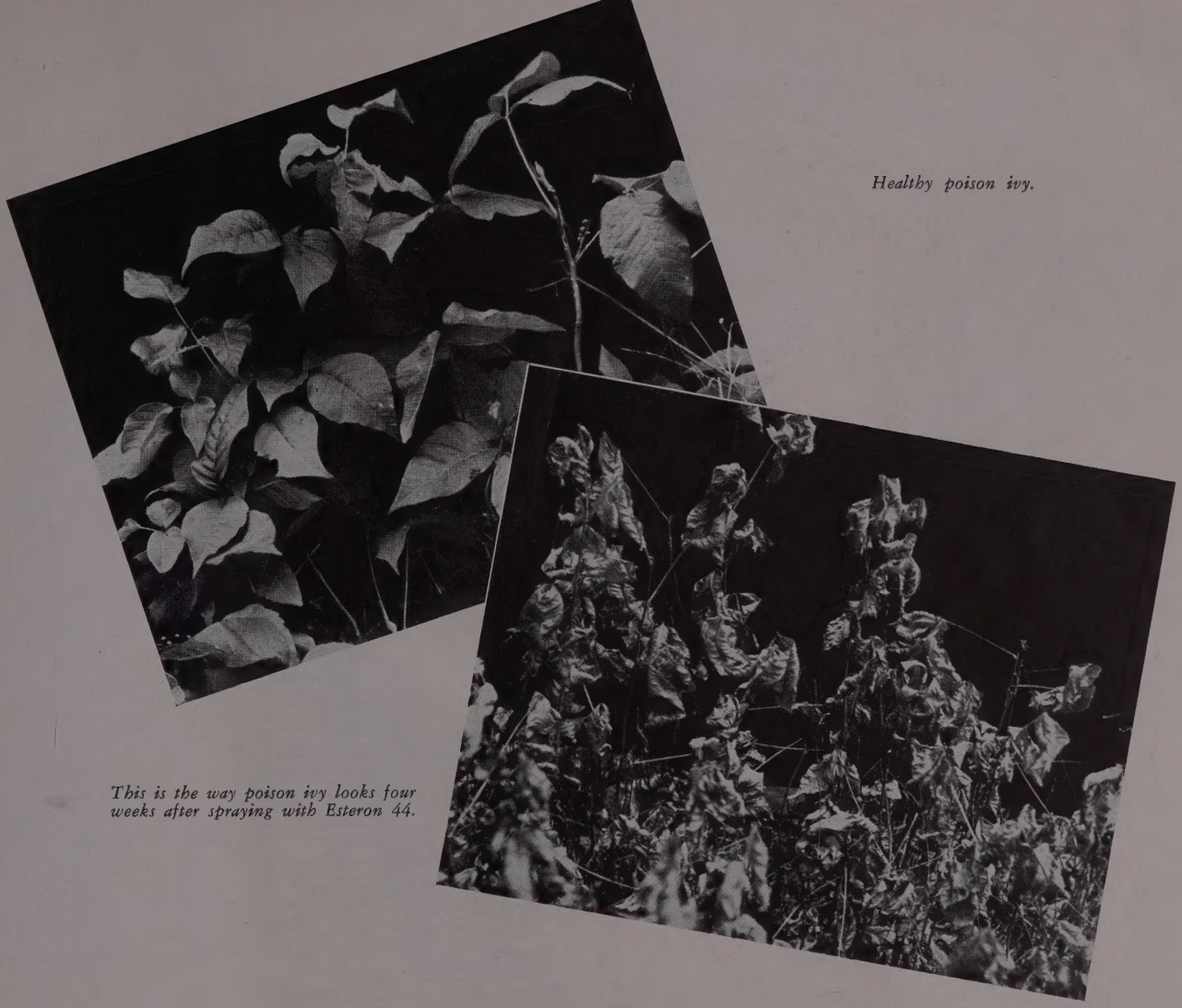
Studies of the best time of the year in which to treat woody plants with 2,4-D are not yet concluded. Apparently the stump treatment may be given any time that growth is taking place. Where brush is cut in the late fall or winter, the treatment should be made in the early spring. Suckers may be sprayed at any time they are actively growing. This, of course, depends on temperature, soil moisture, and the time at which the brush was cut off. New suckers usually under-go a flush of growth after which they tend to harden off. It is during the period of rapid growth that the best results seem to be obtained. This is in line with observations on the control of herbaceous perennial weeds which are most easily killed when sprayed while in an active vegetative condition.

Various kinds of equipment may be employed for such work. A knapsack sprayer equipped with a quick shut-off valve is suitable for stump treatment work. For spraying suckering growth a power rig equipped with one or more hoses with spray guns fitted with orchard type nozzles will speed up the operation and reduce the cost of application. Spot treatment frequently will prove to be the most economical; but where sucker growth is quite thick, an overall spray may prove desirable. It is sometimes difficult to get good coverage of the shoots of woody plants with boom equipment and manually operated spray guns will then prove more efficient. However, elevated booms are widely used for spraying plants along ditch banks and drainage canals.

The number of applications needed to completely kill woody plants varies with the species, size of the plant and other factors. The amount of subsequent growth has been reduced by as much as seventy-five percent with a single stump or a single sucker treatment. In the experiments under discussion, the fairly susceptible species have been pretty well eradicated by two treatments, while some of the more resistant species have put out regrowth although in a state of reduced vigor. The great reduction in number and vigor of woody plants and the progressively lower costs of subsequent sprays as the population goes down indicates that the operation can be highly profitable on power line rights-of-way, even though the immediate expenditure might be somewhat increased. Cost studies will have to be made under various conditions and over a considerable period of time before final conclusions can be drawn. It seems reasonable to state that from the long range standpoint, right-of-way maintenance costs in non-agricultural areas where woody plants are a serious problem, can be reduced by fifty percent by the proper use of Esteron 44. No doubt this material will prove equally valuable for many highway and railroad right-of-way maintenance problems.

Drainage ditches are seldom maintained in the eastern half of the United States. Drainage commissions are frequently allotted money for construction, but nothing for maintenance. Re-dredging is a very costly operation, especially when the ditch has grown up with woody plants. Continuous maintenance should be a practical and money-saving proposition now that suitable chemicals are available. Once a ditch is put in good shape, an occasional spray with Esteron 44 will not only prevent woody plants from getting started, but will also kill many herbaceous weeds that clutter up ditches and reduce the flow of water. Fence rows may be considered in the same category as ditches as something that should be, but seldom are, properly maintained.

Poison ivy, honeysuckle, wild grape and other vine-type woody plants can usually be treated only by a leaf spray. Even with these plants it is probably best to clean out excessively tall viny growth during the dormant season and then spray the new growth as it develops. Poison ivy will usually require more than one application for eradication, none the less, in view of the low cost of the chemical and the fact that grass is not injured by it, 2,4-D appears to be the best available material for its control. Definitely better results have been obtained on poison ivy with the ester compositions than with the water soluble forms of 2,4-D. It should be sprayed after the leaves are well developed, but preferably before they become too mature. In some



Healthy poison ivy.

This is the way poison ivy looks four weeks after spraying with Esteron 44.

instances plants growing in the shade do not respond as well to 2,4-D treatments as when growing in the full sunlight. Even so, poison ivy growing in the shade can be eradicated if the new growth returning after one treatment is promptly sprayed again. There are indications that the shade factor are more likely to impair results in the early part of the season than later on.

In more arid sections of the United States the control of brush with 2,4-D is made more complicated by the long periods during which plants are not actively growing due to lack of water. However very encouraging results have been obtained on species of mesquite with ester formulations of 2,4-D applied during periods of active growth. The use of newly developed 2,4-D dusts applied by plane may be the key which will enable the rancher to treat large acreages while climatic and growth conditions are favorable. In the Texas Gulf Coast country considerable area of pasture land has been overgrown by the wild Cherokee rose which grows to heights of 8-10 feet. It has been found that a single application of a 2,4-D spray at standard dosages will give a very high degree of control with very little recurrence. Because of the extremely thick, thorny growth habits of this plant it is difficult to cut before spraying and it is usually treated without being cut.

Based on the Dow-West Penn. experiments and reports from experimenters elsewhere, the following list of woody plants which have been successfully controlled with Esteron has been prepared. A second list includes those species which have been found to be difficult to control with 2,4-D. Where the bulk of woody vegetation is among the first group, the use of 2,4-D is very promising indeed. Where plants included in the second list are dominant, one will have to approach the problem in an experimental frame of mind. Possibly a kill may be obtained by repeated applications. No doubt species differences exist which may make this list inadequate. Thus, among the many species of oaks, there may be some more responsive to 2,4-D than those observed thus far. Variations in response between species of wild rose and wild apple have been reported.

Strain or varietal differences within species with respect to the amount of 2,4-D required to kill have been observed in a few instances. Such hereditary variations may account for the divergence of results observed by different investigators with such plants as poison ivy. On the other hand many of these differences may be the result of plants in various tests being in different stages of growth at the time

of spraying. Almost without exception the best results have been obtained when plants are in a state of active vegetative growth.

Woody Plants Which Have Been Killed With Esteron

alder (Alnus spp.)
aspen (Populus spp.)
barberry (Berberis spp.)
birch (Betula spp.)
box elder (Acer negundo)
buck-brush (symphorocarpus spp.)
cherokee rose (Rosa laevigata)
chokecherry (Padus nana)
cottonwood (Populus spp.)
currant (Ribes spp.)
dogwood (Cornus spp.)
elm (Ulmus spp.)
elderberry (Sambucus canadensis)
gooseberry (Ribes spp.)
hawthorn (Crataegus spp.)
hazel (Corylus spp.)
honey suckle (Lonicera canadensis)
locust (Robinia pseudoacacia)
mesquite (Prosopis juliflora)
mountain ash (Sorbus americana)
osage orange (Malcura pomifera)
poison ivy (Rhus toxicodendron)
western poison oak (Rhus diversiloba)
poison sumac (Rhus vernix)
poplar (Populus spp.)
red osier dogwood (Cornus stolonifera)
sassafrass (Sassafras officinale)
shad-bush (Amalanchier spp.)
sumac (Rhus spp.)
sweet fern (comptonia peregrina)
sycamore (Plantanus occidentalis)
tulip poplar (Liriodendron tulipfera)
virginia creeper (Psedera quinquefolia)
walnut (Juglans nigra)
wild apple (Malus spp.)
wild cherry (Prunus spp.)
wild grape (Vitis spp.)
wild rose (Rosa spp.)
willow (Salix spp.)

Woody Plants That Are Difficult To Control With 2,4-D

american meadow-sweet (spiraea latifolia)
ash (Fraxinus spp.)
hickory (Carya spp.)
maple (Acer spp.)
oak (Quercus spp.)
sheep-laurel (kalmia angustifolia)
wild blackberry and other brambles (Rubus spp.)

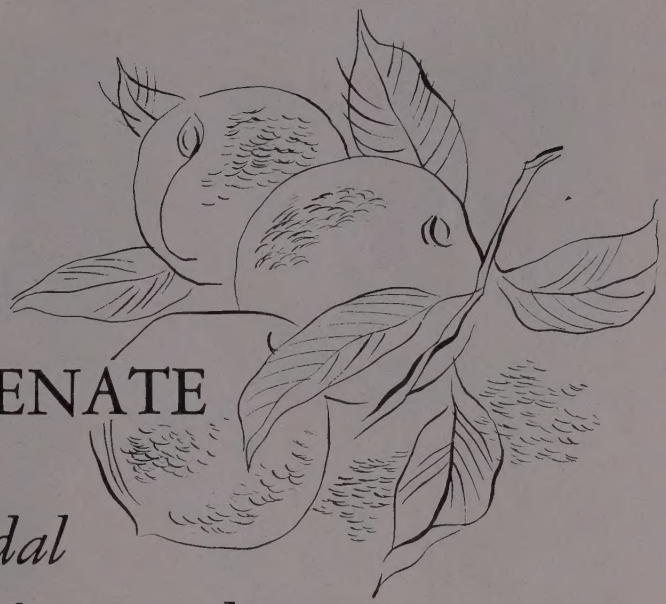
Summary of Recommendations

Based on experiments conducted thus far the following tentative recommendations may be made for the control of woody vegetation with 2,4-D.

1. Use a composition containing an ester of 2,4-D, such as Esteron 44.
2. In general do not spray tall, woody plants, especially when the wood is mature, but cut them off and start from there.
3. Immediately after cutting or before new growth begins, spray the stumps and stubs enough to wet with a solution consisting of one part Esteron 44 and ninety-nine parts kerosene.
4. When any suckers that may develop after the above treatment are two to four feet tall, spray the leaves with Esteron 44 at a concentration of two or three pints per one hundred gallons.
5. If growth is not tall enough to warrant cutting off before starting the control program, or if a vine type of growth is involved, the stump spray can be omitted and the leaf spray applied as suggested above.
6. The amount of re-growth that will occur will vary with the species, extent of root reserves and other factors. Whenever new growth does develop, spray again as directed under (4).

This spray rig is being operated by the West Penn. Power Company in weed-control experiments. The firm plans to use several 4 wheel drive trucks in their 1947 right-of-way spraying operations. The movie crew were filming the scene for a chemical weed control movie to be released by The Dow Chemical Company at a later date.

SODIUM PENTACHLORPHENATE



As a dormant fungicidal spray on deciduous fruit and nut trees

THERE ARE OVER 100,000 acres of almonds and 70,000 acres of apricots in California alone. For many years farmers operating these orchards have been confronted with two serious fungus diseases which, in certain years, have been known to cause infections resulting in the loss of 60% to 70% of the crop. These fungi, known as BROWN ROT (*Sclerotinia laxa* Ader and Ruh) and SHOT-HOLE (*Coryneum beijerinckii* Oud.), cause serious outbreaks during winters of heavy rainfall, especially when the rains occur during the blossom period.

In order to combat these diseases on almonds and apricots, farmers have for many years used sulfur and copper protective sprays throughout the dormant and blossom periods. By following this program diligently and having the sprays on at the proper time, they have been able to reduce infections by as much as 50% to 60%. This, however, has never been considered satisfactory control and research workers have been constantly searching for a better means of combatting these fungus diseases. Protective sprays have never been too successful due to the difficulty in keeping the copper or sulfur deposit on the necessary parts of the tree during periods of heavy rainfall. Furthermore, as new blossoms open they are left unprotected between sprays.

Work on this problem was started in the winter of 1940 by members of Dow's Great Western Division Agricultural Laboratory. This problem developed into a cooperative program with Dr. E. E. Wilson of the University of California, College of Agriculture at Davis in 1942. It was thought that a dormant spray which would kill the over-wintering stages of these fungi would be the ideal way to handle this problem. The over-wintering stages of these fungi are in the form of mycelia found inside the buds, blossoms and twigs which have been killed by the infections of the previous year. Spore-masses arising from these mycelia during the winter months yield the spores which cause the subsequent bud, blossom, twig and leaf infections. With these facts in mind, many chemicals were tested in an attempt to find one that would penetrate these infected parts of the tree and destroy the fungus mycelium without injurying the living parts of the tree. The University of California had developed the use of sodium dinitro cresylate and calcium arsenite for this purpose, but these chemicals were not too satisfactory because of their toxic nature, both to plants and to animals.

In this early work considerable attention was paid to the chlorinated and nitrated phenols. These were used in both the oil-soluble and water-soluble forms. It was hoped that some of these phenols when applied in oil would give the penetration necessary to kill the mycelia within the dead buds and twigs. This turned out to be the case, but the factor of injury to the living parts of the tree was so

Left: Healthy apricot blossoms.
Center: Effect of Brown Rot on apricots.
Right: Almond Brown Rot; tiny grey mushroom-like bodies are spore masses.

great that it became necessary to discontinue the use of any oil with dormant applications of these phenols. The water soluble forms of these chemicals did not give the desired penetration and kill; however, they were relatively non-injurious to living tissue of these dormant trees and showed a definite degree of control.

After this failure to obtain eradication of the over-wintering fungus mycelia inside the dead tissue on the trees, it was felt that spore-masses might be destroyed after they appeared in late December and January. By doing this, it was hoped that the source of spores could be eliminated for a period extending beyond the blossom and rainy period. Emphasis was placed on the water-soluble forms of these chemicals inasmuch as they showed little or no tree injury. As a result of exhaustive tests during the years 1942-1945, it was found that Sodium Tetrachlorphenate (Dowicide F) and Sodium Pentachlorphenate (Dowicide G) were consistently the best in destroying the spore-masses and thereby protecting the blossoms throughout the subsequent blossom period. Dowicide G gave approximately 10% better control than Dowicide F in almost all tests; consequently, most of the work in 1945 and 1946 was with various formulations containing Sodium Pentachlorphenate.

In the use of Sodium Pentachlorphenate as a dormant tree fungicide spray, timing is of utmost importance. In the control of blossom brown rot, it is necessary to wait until all the spore-masses have appeared on the surface of the dead twigs and blossoms from the previous year. Also, the sprays must be applied before the bud scales have opened sufficiently to allow spray to enter and injure the tender blossom parts. It was discovered that this period during which it would be safe to spray almonds was no longer than four weeks in most years. The work on apricots has not progressed to the point where a recommendation can be made.

Regardless of how careful spray operators may be, it is practically impossible to obtain complete coverage of all blighted parts of the tree. Speed sprayers and vapor sprayers probably give the most complete coverage. For the reason that there is bound to be a small percentage of unaffected spore-masses left in the trees we found it desirable to apply one 5-5-50 Bordeaux spray during the popcorn stage of blossom development. This gives the blossoms a protection against the small percentage of brown rot spores remaining in the trees, and those blowing in from other orchards, sometimes many miles away. Therefore, it is our recommendation that the above Bordeaux spray be applied following a dormant application of Sodium Pentachlorphenate.

Data relative to the control of Shot-Hole fungus are rather meager due to the lack of serious infections in re-

cent years. This fungus infects blossom buds, open blossoms and leaves. The lesions on the leaves cause round dried up areas which ultimately fall out giving the trees the appearance of having been showered with buck-shot. The data gathered to date, however, indicate that this chlorinated phenol is equally as effective in controlling Shot-Hole Fungus as it is in controlling Blossom Brown Rot Fungus.

It was demonstrated in the field work that the addition of 50% bentonite to the Sodium Pentachlorphenate gave a composition which, when applied to the dormant trees, would weather better than the straight sodium salt. A wetting agent (Grasselli IN181P which is 50% sodium lauryl sulfate) was discovered to be an aid in reducing the surface tension of the spray when it came in contact with the spore-masses, thereby resulting in a more complete kill. The formulation now used in California for the control of Blossom Brown Rot on Almonds is:

Dowicide G .....@ 4 lbs. per 100 gal. spray
Bentonite .....@ 4 lbs. per 100 gal. spray
Grasselli IN181P .....@ 2 ounces per 100 gal. spray

The past three years have been quite mild with regard to Blossom Brown Rot infections. The average blossom infection for the Sacramento Valley is indicated in the following table compiled by Dr. E. E. Wilson of the University of California at Davis.

Average blossom infection—Unsprayed orchards

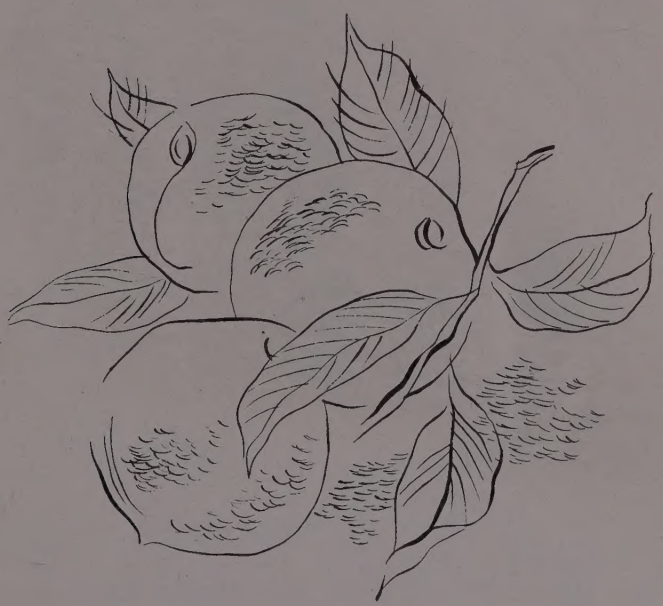
1944 .....21.9%
1945 .....21.7%
1946 .....13.6%

The spur on the left was sprayed 3 to 5 times with Bordeaux 8-8-50 between the times when the buds were first opening and full bloom and shows the toleration of apricot blossoms to such sprays.

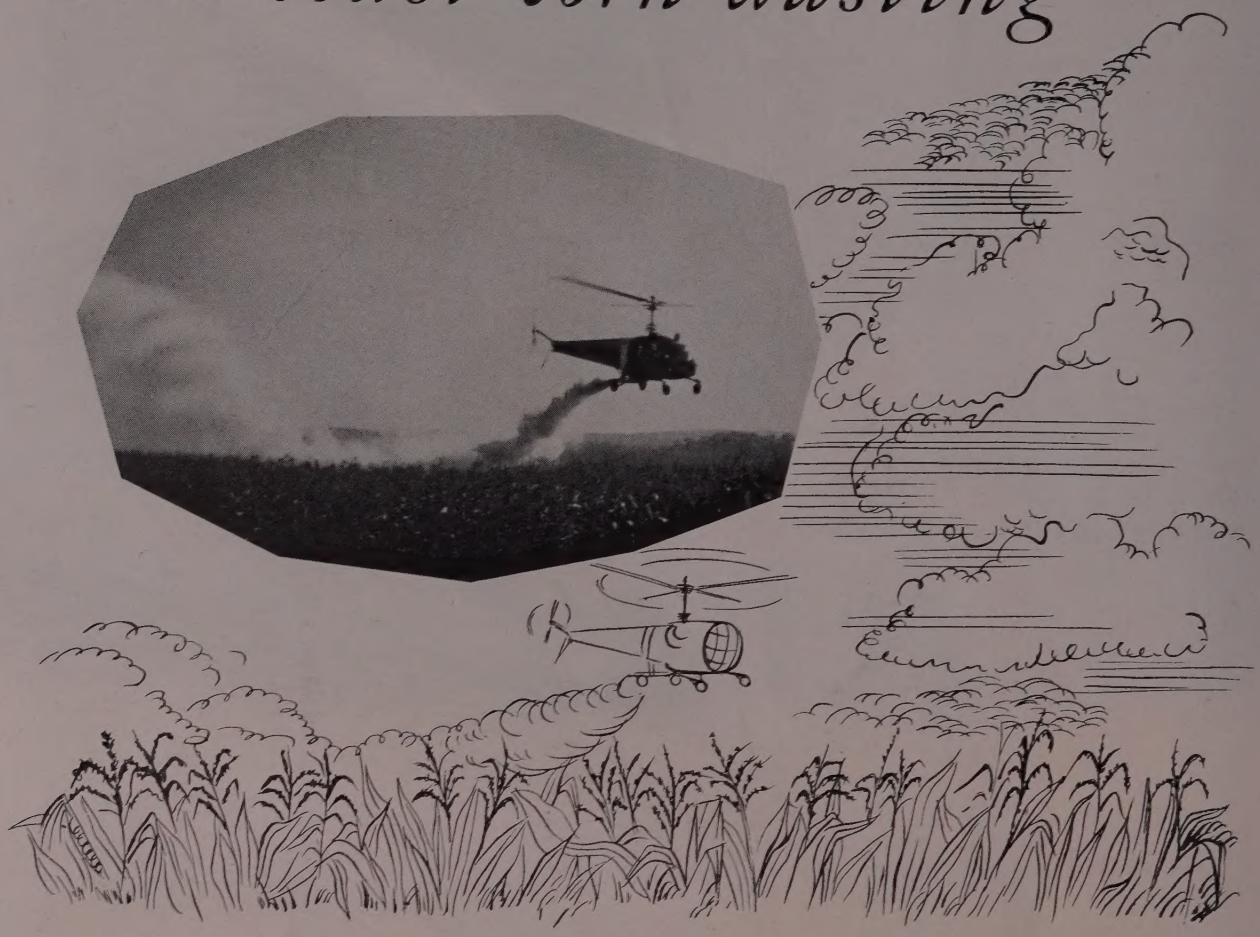
For the same three year period the following table indicates the average reduction in Blossom Brown Rot infections by using Bordeaux alone, Dow Dormant Fungicide alone, and a combination of both.

Percentage reduction—Blossom Brown Rot infection.

Dow Dormant Fungicide
(One spray in January) .....66% reduction
5-5-50 Bordeaux (One spray
at popcorn stage) .....57% reduction
Combination of above .....89% reduction



Helicopter used in west coast corn dusting



General Foods Corporation in Experiments at Yakima, Washington Find the Helicopter a Promising Vehicle for Dusting DDT.

DURING THE 1946 SEASON the helicopter was used extensively for experimental spraying and dusting of insecticides in several sections of the United States. The Birds Eye—Snider Division of General Foods Corporation was among the firms using this unique crop-dusting vehicle. Experiments made in dusting corn for ear worm control at Yakima, Washington this summer represent the first helicopter corn dusting on the west coast.

Lester W. Hanna, entomologist for the Western Division of General Foods Corporation believes that the helicopter has a promising future in this field. The machine has several advantages over airplanes. Helicopters can be used at reduced speeds on small areas and are not handicapped by

trees and other obstacles that impede airplane dusting. Downdrafts caused by the helicopter's roter blades are instrumental in forcing insecticides around the base of the plant. The dust trail leaving the machine first makes a straight downward pattern. As downdrafts reach the ground, the dust boils in a mushroom pattern that produces thorough coverage of all areas of the plants.

As far as the effectiveness of the various insecticides applied in the Yakima experiments, Mr. Hanna points out that present available data are inconclusive. He believes that DDT is undoubtedly a specific on the Corn Earworm. Dusting corn with 3% DDT dust a year ago with a bellows hand duster at the rate of 32 lbs. per acre 92% control was obtained on the earworm.

In the helicopter tests using a 5% DDT dust with and without piperonyl cyclohexanone and applying the dust at the rate of about 40 lbs. per acre a reduction of 50% of the worms was noted. Experiments indicate that DDT will control earworm. The correct timing, insecticide poundage, as well as the concentration of the dust will undoubtedly have to be adjusted to the conditions in the locality where it is used. While yield data is not at this time available, it is apparent that DDT plots show a substantially increased yield over the check plots.

More experimental work is planned by General Foods. The table on this page shows the corn earworm percentage counts from preliminary experiments in July, 1946.

CORN EARWORM PERCENTAGE COUNTS FROM HELICOPTER EXPERIMENTAL CORN DUSTING IN YAKIMA, WASH.

Applied — July 18, 1946

Farm	*Dust*	*Worm Percentages July 25th 1st Reading*	*July 31st 2nd Reading*	*Average*		*Remarks*
Benny	DDT 5%—P.C.H.	20%	22%	21%		Fairly good control
Ough	DDT 5%	28	18	23		Fairly good control
	Non-Toxic Dusts					
Bidstrup	Dichlorodiphenyl dichloroethane 3%	26	24	25	24%	Fair
Bidstrup	"	20	25	22.5		
Bidstrup	Ryanex 50%	40	36	38		Dust did not reach silk well. Good results last year.
Bidstrup	Sabadilla 10%	28	38	33		Poor
Bidstrup	P. C. H. 1%	40	38	44		Concentration too low — poor.
Bidstrup	Dianisyltrichloroethane 3%	28	28	28		Fair
	Checks Untreated					
Bidstrup	Check	54	48	51	42%	Average field infestation of worms on earliest corn.
Bidstrup	Check (older corn)	40	41	40.5		
Ough	Check	36	34	35		

Dusts applied at the rate of 40 lbs. per acre. Dusted when first silks were beginning to dry. This table is based on 500 ears of corn examined for each count (reading) per each insecticide used as well as each untreated check.

Conclusion

Better results could have been obtained with more poundage, earlier dusting and better helicopter dusting rigging. From the air I estimate 30% loss in effectiveness of dust, which would require a heavier poundage to compensate for the loss. The helicopter is a most promising contrivance for future aero-dusting.

This experimental helicopter is a product of Bell Aircraft Corporation.

AIF Meet

Outlines future research needs

Speakers and delegates at the 13th annual meeting of the Agricultural Insecticide and Fungicide Association discuss new products in terms of extensive future research.

RESEARCH AND INDUSTRIAL LEADERS attending the September 5 and 6 meeting of the AIF at Spring Lake, N. J., reported on both new products and those winning wide acceptance in today's agricultural chemical market. George Kreiger of the American Petroleum Institute; Ray Cuff of the National Live Stock Loss Prevention Board; and F. C. Bishopp, Assistant Chief, Bureau of Entomology and Plant Quarantine; gave reports of special interest to those interested in agricultural chemical research.

Teamwork Needed

George Kreiger pointed out that in modern farming profit depends on "skill, not price". "Skill", said Mr. Kreiger, "gets that job done. Skillful farming will be the greatest boon this country has known in many a year. But half-baked measures, partial experiments, temporizing, substituting and evading will delay and even defeat the first real attempt at modernization of agriculture in several generations."

The petroleum industry, Mr. Kreiger reported, intends to consider and help finance problems and research projects. Regional committees will be set up to investigate agricultural problems in their own area. Mr. Kreiger explained that it was unwise and undesirable to make new products available to the farmer until specific recommendations for application could be made.

Tomorrow's Livestock Sprays

Ray L. Cuff, Kansas City regional manager for the National Live Stock Loss Prevention Board outlined some dollars and cents results of DDT treatment. Data from this year's work showed that treated cattle gained an average weight of 50 pounds per head for the season with the use of five cents worth of DDT.

Mr. Cuff said, "This year in Kansas and Oklahoma cattle are being sprayed for flies because it pays. . . . One pound of your technical grade DDT helped produce an average of 1200 extra pounds of beef, and as high as 2,300 pounds in some cases." He added that tests on three dairy herds in Missouri are producing comparable gains in milk yields.

The speed of modern treating methods has sharply reduced costs. Mr. Cuff explained that 1330 cattle have been treated through an eight foot shoot in half an hour. But cattlemen still hope for a more perfect spray. They would like to see a compound "that kills all flies that light on the animal and will continue to kill for two weeks."

One note of special interest in Mr. Cuff's talk was a statement on fly control in general. He said, "In a few places in Kansas, cattlemen started spraying a few trees with DDT to get rid of stable flies. To their surprise they also killed many Tabanids—the big horsefly . . . And in Ellsworth County, Kansas, where all the cattle and many farm buildings for 90 square miles have been sprayed one man said, 'This is the first summer I can remember when we did not actually need screen doors'."

Reporting on other insecticides Mr. Cuff said, "We found that benzine hexachloride works much better in fall and winter than in summer heat. It is one of the few chemicals that will kill both the cattle lice and their eggs at one treatment. Tests with the methoxy analog of DDT have given uniformly good results. A new fixed pyrethrum we have tried gives much longer residual effect than the old standard material."

No Cure All

Dr. F. C. Bishopp, assistant chief of the Bureau of Entomology and Plant Quarantine gave a detailed report on many new compounds and pointed out that while many new products give amazing results, there is still no "shotgun remedy," effective against all insects, in sight.

A summary of part of the detailed preliminary findings on 9 new compounds discussed by Dr. Bishopp follows:

Benzine Hexachloride

Much remains to be done in standardizing commercial benzine hexachlorides. Since there is considerable variation in products tested, results lack uniformity. The product is less persistant than DDT as a residual spray for mosquitoes and houseflies, but produces a more rapid knockdown of the

yellow-fever mosquito than DDT. It will kill body lice in very low dilution. It has striking effectiveness against cattle lice and cattle grubs . . . special promise for use against cotton insects. The compound shows great promise against the white-frigged beetle . . . stored grain insects . . . against tobacco thrips on peanuts and the vetch bruchid on hairy vetch . . . against the sugar cane borer, the corn flea beetle, the corn earworm on corn, and lygu bugs on alfalfa. Other pests which benzine hexachloride shows high toxicity includes grasshoppers, Mexican bean beetles, green peach aphids, and many pecan pests.

Hexaethyl Tetraphosphate

This material, used as an insecticide in Germany during the war, is being tested here because of its reported efficiency against aphids. The material is readily hydrolyzed, and in some formulations loses its killing powers in a few hours. The compound is highly toxic to higher animals. Rapid decomposition apparently removes any serious residue problem.

Azobenzene

Tests at Beltsville and elsewhere indicate that this chemical is an effective fumigant for the eggs of the common red spider. In laboratory tests the compound has proved effective against the two-spotted mite in a wettable powder form.

3956

This compound has marked insecticidal power but is slow to knockdown and kill. Tests indicate it is more toxic against body lice than DDT. Laboratory tests show it effective against young European corn borer.

1068

The toxicity of this compound equals that of DDT to malaria mosquito larvae. The chemical showed promise on body louse, the German cockroach, pea aphid, grasshoppers, and the confused flour beetle.

Methoxy analog of DDT

Lower toxicity against higher animals and a distinct insecticidal value are encouraging the development of this analog.

Flourine analog of DDT

German research groups consider this material superior to DDT because of its quicker action. It is less toxic, however, and its manufacturing cost is higher.

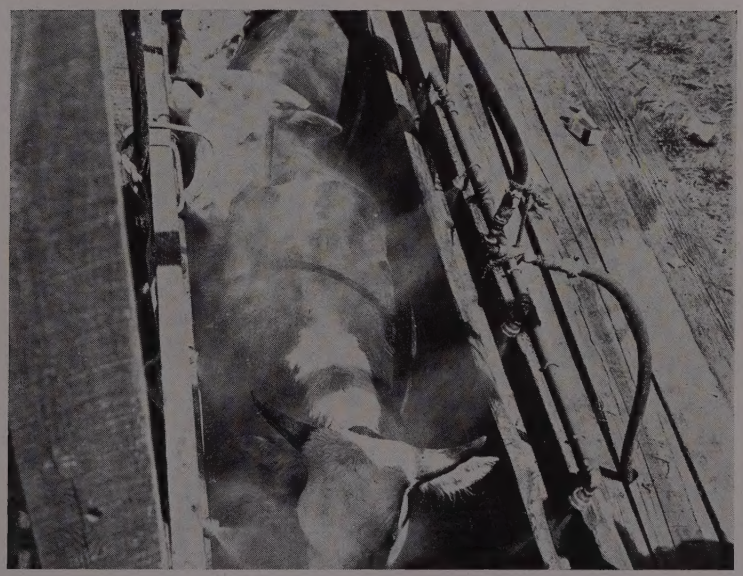
Hydroxypentamethylflavan

This compound offers excellent chigger control when applied to the soil. This is encouraging further tests against plant-infesting mites.

Synergists

Synergists, or activators, designed to extend or supplement pyrethrum are the objects of much research. Substituted piperonyl cyclohexanones show insecticidal value in tests aside from their synergistic effect on pyrethrins.

Cattle being sprayed with DDT in Kansas.



By R. B. NEISWANDER
Ohio Agricultural Experiment Station
Wooster, Ohio

Better Dahlias Produced

if sprays or dusts are applied

"Ogden Reid." A dahlia dusted five times with 3 per cent DDT and twice with DN 269. (Plant donated by E. J. Wind)

INSECTS NO DOUBT cause more damage to dahlias than growers commonly realize. Leafhoppers and thrips are usually the most troublesome pests. Thrips are especially troublesome because they spread a disease known as Australian Spotted Wilt. Thrips that grow from egg to adult on diseased plants may infect tomato plants also, because the tomato is one of the many other hosts for the virus. The fact that the disease organism may live over winter in dahila tubers makes it doubly important that thrips on dahlias be controlled.

During recent years numerous detailed experiments on potatoes and tomatoes have proven DDT to be very effective in the control of both thrips and leafhoppers. During the summer of 1945 an experiment was arranged to test DDT on dahlias. The work was planned by Dr. L. J. Alexander, plant pathologist of the Ohio Agricultural Experiment Station, and the writer in cooperation with Mr. E. J. Wind, a well known professional dahlia grower at Rocky River, Ohio.

In order to determine the effect of DDT on dahlia plants, a small portion of Mr. Wind's planting was sprayed in a preliminary application. Two rows, each nearly 100 feet long, were sprayed with DDT at the rate of ½ pound (2 pounds of a 25% formulation) per 100 gallons. Subsequent observations indicated that both thrips and leafhoppers were well controlled on the sprayed plants. and no injury could be detected that was caused by the DDT.

Mr. Wind began spraying the entire planting at intervals of 2 weeks with DDT at the rate of ¾ pound per 100 gallons. The dahlias grew vigorously and Mr. Wind re-

ported that the foliage was the most luxuriant he had ever grown. During the latter part of August, however, red spider began to appear on the plants and soon become very abundant. Red spider has not been a common or severe pest on dahlias, but with other plants, an increase in red spider damage following the use of DDT is not unusual. Not only does this insecticide not injure the mites, but it kills many of the natural enemies of the mites. Also, the more luxuriant plants resulting from the absence of insect injury may constitute a more suitable food for the mites.

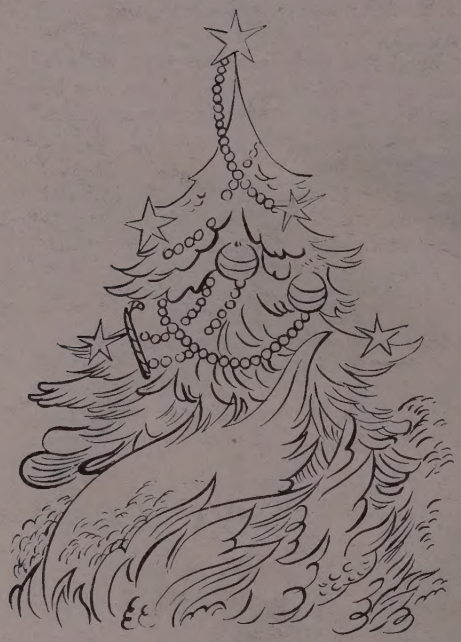
Previous studies had shown Dowspray 17 to be one of the most effective materials available for the control of the common red spider, but it had not been tested on dahlias. Consequently, on September 3, as a preliminary experiment, a spray containing ¾ pound of Dowspray 17 and ¾ pound of DDT per 100 gallons was applied on a small portion of the planting. Counts made of a few days later showed that more than 95 per cent of the mites on the sprayed plants were dead and no injury could be detected that was caused by the spray material.

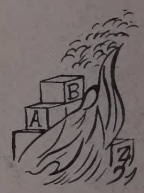
Following this experience Mr. Wind sprayed the entire planting very carefully with the combination just stated and almost eliminated the red spider population with one application. Flowers from this planting later won prizes, including sweepstakes at the Midwest Dahlia Show.

In Mr. Wind's Dahlia Blue Book for 1946 he makes the statement: "We found that varieties which were difficult to grow because they were not 'insect resistant' can now be grown with ease by intelligent use of these new materials. It will no longer be necessary to pass up beautiful varieties because they require undue care."

During the summer of 1946, at the Ohio Agricultural Experiment Station, excellent foliage and blooms were produced on plants that were dusted at regular intervals with a 3 per cent DDT dust, and later were dusted with DN dust 269 when the red spider appeared. Similarly favorable results were obtained in another plot that was sprayed at regular intervals with an experimental material not yet on the market. The new material is a liquid containing both DDT and a chemical that is effective against red spider. This work was done in a cooperative project in which The Dow Chemical Company prepared all of the materials.

"Mrs. Richard C. Atchison." A dahlia dusted five times with 3 per cent DDT and twice with DN 269. (Plant donated by E. J. Wind)





CHEMICALS *reduce Christmas tree fire hazard.*

The Christmas tree has long been recognized as a fire hazard. The United States Department of Agriculture has learned how to replace lost moisture with fire-resisting chemicals.

WHILE FRESHLY CUT TREES do not ignite easily, Christmas trees quickly lose their moisture in the home and constitute serious fire hazards. Christmas trees are especially hazardous because they contain resinous substances. While no one has collected statistics to establish the extent of the hazard, the National Board of Fire Underwriters regard it as "very great."

Several years ago the United States Department of Agriculture published relative to treating trees with certain chemicals which render wood and pine needles resistant to fire.[1] Either ammonium sulfate or calcium chloride can be used in solutions for treating trees.

Trees should be treated as soon as possible after they are cut. The cut end of the tree is placed in a solution. Freshly cut trees still have a water absorbing power which permits introduction of either chemical into the tree in solution form.

Either calcium chloride or ammonium sulfate may be used in the same quantities. A summary of the recommended treatment follows:

The quantity of the chemical used should equal ¼ the weight of the tree. Dissolve the chemical in water at the rate of 1¼ pints per pound of chemical. Set the tree in the solution in a room of moderate temperature (55 to 65°F.). The tree stem should be freshly sawed "preferably at an oblique angle or in a V shape in order that the chemical solution may have free access to the wood at the cut end." The tree should be left in solution until needed. The degree of fire resistance depends on the amount of solution taken up by the tree. Freshly cut trees respond most readily to treatment.

It is pointed out that a properly treated tree will not burn even when exposed to a large flame; however, the degree of fire resistance will vary with the amount of chemical absorbed; and the quantity absorbed will of course vary with the freshness of the tree. Any treated tree should be less hazardous and needle fall will be retarded.

[1] Martin Leatherman, "Fireproofing Christmas Trees," Leaflet No. 193, U. S. Department of Agriculture.